Catalogue of American Amphibians and Reptiles.

GEHLBACH, FREDERICK R. 1967. *Ambystoma tigrinum.*

Ambystoma tigrinum (Green)
Tiger salamander

Salamandra tigrina Green, 1825: 116, pl. 25, fig. 7. Type-locality, "near Moore's town [Moorestown, Burlington County] in New Jersey." Holotype not known to exist; collector unknown.

Salamandra ingens Green, 1831: 254. Type-locality, "near New Orleans" (Louisiana). Holotype, Acad. Nat. Sci. Philadelphia 1309; collector unknown.

Salamandra lurida Sager, 1839: 323. Type-locality not mentioned. U. S. Natl. Mus. 3970, 3899, 39442 from Detroit, Wayne County, Michigan are *S. lurida* (Dunn, 1940). Holotype, U. S. Natl. Mus. 39442, collected by A. Sager (Cochran, 1961).

Ambystoma episcopus Baird, 1850: 284, 293. Type-locality, "Kemper County, Mississippi." Holotype not known to exist, collected by C. Lloyd.

Siredon harlanii Dumeril, Bibron, and Dumeril, 1854: 181, pl. 95, figs. 1, 1a. Type-locality, "Caroline (U. S. A.)." Lectotype, Mus. Nat. D'Hist. Natl. Paris 4777, collected by R. Harlan (Gehlbach, 1966).

Ambystoma bicolor Hallowell, 1857: 215. Type-locality, "near Beesley's Point, New Jersey" (Cape May County). Holotype, Acad. Nat. Sci. Philadelphia 10584, collected by S. Ashmead.

Ambystoma conspersum Cope, 1859: 123. Type-locality, "Londongrove, Chester County, Pennsylvania." Holotype, Acad. Nat. Sci. Philadelphia 10589, collected by E. D. Cope.

Amblystoma xiphias Cope, 1867: 192. Type-locality, "Columbus, Ohio" (Franklin County). Holotype, U. S. Natl. Mus. 14470 (formerly 4135; Cochran, 1961), collected by L. Lesquereaux.

Amblystoma obscurum Baird *in* Cope, 1867: 192. Type-locality, "Fort Des Moines, Iowa" (Polk County). Holotype, U. S. Natl. Mus. 3994, collected by W. E. Moore.

Amblystoma copeianum Hay, 1885: 209, pl. 14. Type-locality, "Irvington, near Indianapolis" (Marion County, Indiana; presently within Indianapolis). Holotype, U. S. Natl. Mus. 14112, collected by G. H. Clarke.

• CONTENT. Seven subspecies are recognized; they are *tigrinum, mavortium, nebulosum, californiense, melanostictum, velasci,* and *diaboli.*

• DEFINITION. Metamorphosed, reproductively mature adults are large (75–160 mm. snout-vent) with small eyes and broad head (interorbital distance 1.5–5.0 times eye width), 11–14 costal grooves (usually 12 or 13), a straight to slightly arched vomerine tooth row (sometimes separated medially), two palmar and two plantar tubercles, and a dorsal coloration of spots, blotches, bars, or reticulations on a lighter or darker background (occasionally unicolor). The pond-type larvae lack balancers, hatch at 10–17 mm. total length, have 13–24 rakers on the anterior face of the third gill arch, and usually metamorphose at 45–85 mm. snout-vent but may become neotenic and exceed adults in size. Eggs are 2–5 mm. in diameter with three envelopes, the outermost 5–12 mm. in diameter, and are laid singly or in gelatinous masses (with up to 110 eggs) attached to or independent of vegetation.

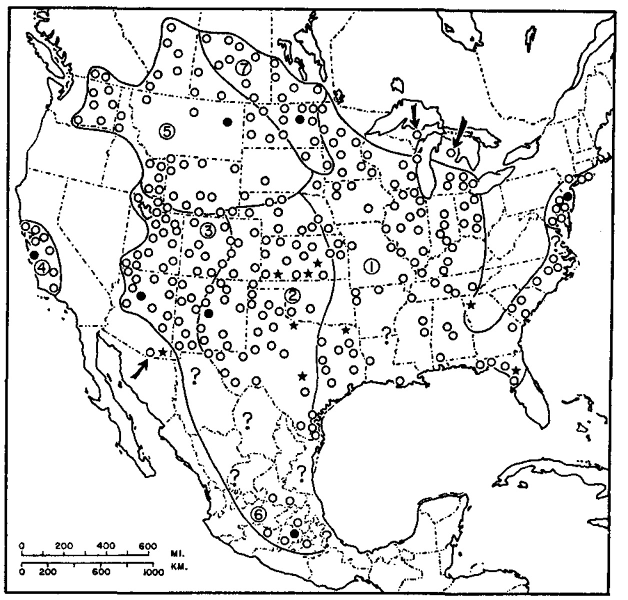
• DESCRIPTIONS. Comprehensive accounts, including several subspecies and life history stages, are by Bishop (1943) and Stebbins (1951). Other adults are described by Lafrentz (1930), Lowe (1955), and Taylor (1952, 1953). Details of adults, subadults, and larvae are in Breckenridge (1944), Dunn (1940), Gehlbach (1965b), Lowe (1954), H. M. Smith (1934), and P. W. Smith (1961). Larval descriptions are by Brandon (1961) and Powers (1907), egg descriptions by Slater (1937), H. M. Smith (1934), and Twitty (1941). Bishop (1941) and Storer (1925) provide the most complete data on all life history stages in one subspecies. The spermatophore has not been described.

• ILLUSTRATIONS. Photographs of adults and/or subadults are in Bishop (1941, 1943), Conant (1958), Gehlbach (1965b), Lowe (1955), Rossman (1965), H. M. Smith (1934, 1950), P. W. Smith (1961), Slevin (1928), and Storer (1925); illustrations in Stebbins (1951, 1966) and Humphrey (1967) are in color. Eggs and larvae are shown in Bishop (1941, 1943), H. M. Smith (1934, 1950), Stebbins (1951, 1966), and Storer (1925); Powers (1907) illustrates larvae. All stages, the spermatophore, breeding pond, and a female laying eggs are shown in photographs by Stine *et al.* (1954).

• DISTRIBUTION. Found from sea level to 11,000 feet in all biotic communities with substrates suitable for burrowing from the southern limits of boreal forest in central Alberta and Saskatchewan, Canada, south to Hernando County, Florida (limits of mesic-temperate hammock) and Puebla, Mexico (limits of Mexican Plateau). Absent from New England, the Appalachian Mountains, eastern Canada (except Point Pelee, Ontario), the Sierra Madre Occidental and west coast of Mexico, Sonoran and Mohave desert regions, and most of the Great Basin and Pacific Coast of the United States and Canada. A disjunct subspecies inhabits California between Sonoma and Santa Barbara counties west of the Sierra Nevada. Range limits in Virginia, Louisiana, Arkansas, Mississippi, and the Mexican Plateau are unknown. Peripheral records are shown in Cook (1965), Logier and Toner (1961), and Stebbins (1951).

• FOSSIL RECORD. Present in the upper Pliocene and all stages of the Pleistocene Epoch (except perhaps the Nebraskan) in deposits from Arizona, Florida, Georgia, Kansas, and Texas. Recent references are Hibbard and Dalquest (1966) and Holman (1966, 1967). Gehlbach (1965a) gives a chronology of the *tigrinum* complex and references to earlier literature.

• PERTINENT LITERATURE. The only complete taxonomic revision is Dunn's (1940); recent descriptions and partial revisions are by Gehlbach (1965b) and Lowe (1954, 1955). Nomenclatural notes are by Bishop (1942, 1945) and Gehlbach (1966). Topics relevant to taxonomy and natural history include albinism (Humphrey, 1967), osteology and phylogeny (Tihen, 1958), migrations (Duellman, 1954), predators (Long, 1964), warning behavior (Carpenter, 1955), courtship and oviposition (Hamilton, 1948; Kumpf, 1934), food habits (Moore and Strickland, 1955), general life history and ecology (Bishop, 1941; Carpenter, 1953; Gehlbach, 1965b; Stine *et al.*, 1954; Storer, 1925), and larval biology (Brandon and Bremer, 1967; Burger, 1950; Glass, 1951; Knopf, 1962; Marsh, 1868; Powers, 1907). There are many other publications on these subjects, other habits, distribution, anatomy, and especially experimental biology.



MAP. The solid circles mark type-localities, hollow symbols indicate other selected localities. Arrows point to presumably disjunct localities. Stars mark fossil sites (see text).

• Nomenclatural History. Only the first appearance of specific and subspecific taxa and current combinations are cited in synonymies here. Numerous generic allocations (notably *Salamandra, Triton, Heterotriton, Siredon, Camarataxis, Desmiostoma,* and *Axolotus*) and emendations (especially *Amblystoma*) have created an enormous nomenclatural history. Collectively, Cope (1889), Dunn (1940), Slevin (1928), and Smith and Taylor (1948) review this history in their synonymies of *A. tigrinum*. For the use of *tigrinum* see Smith and Tihen (1961).

• Remarks. *A. tigrinum* is quite variable sexually, ontogenetically, and ecotypically. Such variation is reviewed briefly here; color-pattern variations, known to be taxonomically distinctive, are reviewed in the subspecies accounts. The following statements are documented in Gehlbach (1965b, unpubl.) and/or references cited: (1) larval coloration varies with age, turbidity, and depth of water; (2) neoteny (reproductive maturity in larvae) is lacking to frequent depending on pond productivity and permanence, and on physical-chemical features of the water; (3) neotenes may be genetically isolated from transformed individuals (Glass, 1951; Knopf, 1962); (4) larvae have relatively longer tails, wider heads, and longer legs than transformed individuals; (5) larval gill rakers increase in number with body size and decrease gradually upon transformation; (6) recently transformed salamanders resemble larvae in coloration and may remain thus but usually change appreciably; (7) proportionate leg length decreases with increasing body size in transformed individuals and relative tail length and number of teeth increase concomitantly (P. W. Smith, 1961); (8) adult males have relatively longer tails than adult females (Dunn, 1940) and, if aquatic, all adults may have more compressed tails than terrestrial counterparts.

• Etymology. The name, *tigrinum*, from the Latin *tigrinus* (tiger) alludes to tiger-like coloration in some individuals. Subspecific names are derived as follows: *mavortium*, from the Latin *Mars* (derivative mavortial) meaning war-like, perhaps in allusion to bright coloration; *nebulosum*, from the Latin *nebulosus* (cloudy) describing dull coloration in old adults; *californiense*, from the state of California; *melanostictum*, from the Greek *melano* (black) and *sticto* (spotted) describing coloration in some large larvae; *velasci*, a patronym from J. M. Velasco, describer of the form under a preoccupied name; and *diaboli*, from the Latin *diabolus* (devil) in reference to the type-locality, Devil's Lake, North Dakota.

1. *Ambystoma tigrinum tigrinum* (Green) Eastern tiger salamander

Synonymy as in the species account.

Ambystoma tigrinum tigrinum; Dunn, 1940: 156. First use of the trinomial anticipated by Cope (1867).

• Definition. Transformed adults have yellow to olive spots or small blotches (coalesced spots) scattered about equally over the dorsum and sides of the body; there are 15–58 (mean 30) such markings between extremes of limb insertions. Neoteny is rare; larvae have 13–21 (mean 17) rakers on the anterior face of the third gill arch.

• Remarks. Transformed subadults frequently are uniform brown to black or have fewer than 15 yellow spots. Spots increase in number and size becoming dull olive with age; many old individuals are olive with brown to black spots and reticulations (see Baird, 1850; 293; Cooper, 1860: pl. 31, fig. 2). Neotenes from Michigan are olive to brown with scattered dark spots like the neotenes and large larvae of all subspecies.

2. *Ambystoma tigrinum mavortium* Baird Barred tiger salamander

Ambystoma mavortia Baird, 1850: 284, 292. Type-locality, "New Mexico" (probably the Rio Grande valley between Santa Fe, New Mexico, and El Paso, Texas). Holotype, not known with certainty, perhaps U. S. Natl. Mus. 3990, collected by J. L. LeConte (Cochran, 1961).

Ambystoma proserpine Baird and Girard, 1852: 173. Type-locality, "at Salado [Creek] four miles from San Antonio, Texas" (Bexar County; now within the limits of San Antonio). Syntypes (3) U. S. Natl. Mus. 4082, collected by L. A. Edwards (Cochran, 1961).

Siredon lichenoides Baird and Girard, 1852: 68. Type-locality, "in a lake [Spring Lake] at the head of Santa Fe Creek, New Mexico" (Santa Fe County). Syntypes (2) U. S. Natl. Mus. 4061, collected by R. H. Kern.

Amblystoma trisruptum Cope, 1867: 194. Type-locality, "Ocate River, New Mexico" (Mora County). Holotype, U. S. Natl. Mus. 4068, collected by J. Potts.

Ambystoma tigrinum mavortium: Dunn, 1940: 158. First use of the trinomial anticipated by Cope (1867).

• Definition. Transformed adults have narrow to broad vertical bars or large blotches, yellow to olive in color, on the dorsum and especially sides of the body; there are 6–36 (mean 17) such markings between extremes of limb insertions. Neoteny is occasional; larvae have 18–23 (mean 20) rakers on the anterior face of the third gill arch.

• Remarks. Transformed subadults often have fewer, sometimes more, light markings and are more spotted in appearance than adults. As throughout the *tigrinum* complex, light markings increase in size and change color with age. Old individuals and some resulting from metamorphosis of large larvae may be olive or brown with remnants of the black ground color present in a reticulated or marbled pattern (Baird, 1859b: pl. 35, fig. 7).

3. *Ambystoma tigrinum nebulosum* Hallowell. Clouded tiger salamander

Ambystoma nebulosum Hallowell, 1852: 209. Type-locality, "New Mexico" (later said by Hallowell, 1854: 144, to be "San Francisco Mountain," Coconino County, Arizona). Holotype, U. S. Natl. Mus. 4702a, collected by S. W. Woodhouse (Cochran, 1961).

Ambystoma maculatum Hallowell, 1857: 215. Type-locality, "New Mexico." Holotype, perhaps U. S. Natl. Mus. 14481, collected by A. S. McClellan. Allocation of this name is tentative (Gehlbach, 1966).

Ambystoma tigrinum stebbinsi Lowe, 1954: 243. Type-locality, "J. A. Jones Ranch in Parker Canyon, southwest side of the Huachuca Mountains, ca. 5000 ft., Santa Cruz County, Arizona." Holotype, Univ. Arizona 665, collected by C. H. Lowe, 4 November 1950.

Ambystoma tigrinum utahense Lowe, 1955: 246. Type-locality, "Lapoint, Uintah County, Utah." Holotype, Univ. California Mus. Vert. Zool. 29481, collected by D. L. Bills, May 1935.

Ambystoma tigrinum nebulosum: Dunn, 1940: 158. First use of the trinomial anticipated by Cope (1867).

• Definition. Transformed adults have yellow to dark olive spots or blotches (coalesced spots) scattered over the dorsum and sides of the body; there are 11–50 (mean 32) such markings, often with fuzzy or irregular edges, between extremes of limb insertions. Neoteny is common; larvae have 17–24 (mean 20) rakers on the anterior face of the third gill arch.

• Remarks. Transformed subadults are yellow-spotted or reticulated; adults, especially old ones, are less distinctly marked and may be olive to brown with darker spots and reticulations (Gehlbach, 1965b, pl. 2). *A. t. utahense* is the subadult and/or adult end-product of color-pattern ontogeny. Individuals from Arizona and New Mexico, particularly those south of the Colorado Plateau, retain yellow spots longer than specimens from farther north. The isolated Santa Cruz County, Arizona, population (*A. t. stebbinsi*) is known only from small, yellow-spotted, transformed specimens and typical larvae.

4. *Ambystoma tigrinum californiense* Gray California tiger salamander

Ambystoma californiense Gray, 1853: 11, pl. 7. Type-locality, "California, Monterey" (Monterey County). Holotype, not known to exist; collector unknown.

Ambystoma tigrinum californiense: Cope, 1889: 86. First use of the trinomial.

• Definition. Transformed adults have light to dark yellow spots or blotches confined to or concentrated on the sides of the body; there are 8–32 (mean 16) such markings between extremes of limb insertions. Neoteny is unknown; larvae have 18–24 (mean 21) rakers on the anterior face of the third gill arch.

• REMARKS. Transformed subadults may have fewer, rarely more, spots than adults with the spots often scattered over the dorsum. This form does not change color radically with old age, so Baird's (1859a, pl. 30, fig. 3) drawing may be based on *Dicamptodon ensatus*. Often this subspecies has been considered a distinct species (Bishop, 1943; Storer, 1925). The ephemeral nature of its breeding ponds may prevent neoteny.

5. *Ambystoma tigrinum melanostictum* Baird. Blotched tiger salamander

Siredon melanosticta Baird *in* Cooper, 1860: 306. Type-locality, "between Fort Union and Fort Benton, Nebraska" (100 miles west of Fort Union, North Dakota, in the Missouri River valley near Frazier, Valley County, Montana). Holotype, U. S. Natl. Mus. 7043, collected by G. Suckley (Gehlbach, 1966).

Ambystoma tigrinum slateri Dunn, 1940: 159. Type-locality, "Five miles southeast of Coulee Dam, Grant Co., Washington." Holotype, U. S. Natl. Mus. 108982 (formerly College of Puget Sound 2489), collected by J. R. Slater.

Ambystoma tigrinum melanostictum: Bishop, 1942: 256. First use of the present combination replacing the junior synonym, *A. t. slateri*.

• DEFINITION. Transformed adults have irregular yellow to dark olive spots, blotches, or reticulations on the dorsum and sides; these markings usually cannot be counted as discrete entities; background coloration is often darkest bordering the light markings. Neoteny is frequent; larvae have 18–24 (mean 20) rakers on the anterior face of the third gill arch.

• REMARKS. Transformed subadults may have brighter, smaller light markings (sometimes discrete spots) scattered over the dorsum. Old adults become nearly uniform olive to brown but may retain a trace of a darker spotted or marbled pattern (Marsh, 1868, pl. 1, figs. 2, 3). Little color difference between subadults and adults, or between large larvae and adults, obtains in many populations. Specimens from the eastern half of the range cannot be distinguished satisfactorily from *A. t. diaboli* or *A. t. nebulosum*.

6. *Ambystoma tigrinum velasci* Dugès Plateau tiger salamander

Amblystoma velasci Dugès, 1891: 142. Type-locality, "Lago de Santa Isabel, Cerca de la Villa de Hidalgo, Mexico" (Villa Gustavo Madero, Distrito Federal; now within the limits of Ciudad Mexico, Maldonado-Koerdell, 1948). Syntypes not known with certainty, possibly in Museo Alfredo Dugès; collector unknown. Substitute name for *Siredon Tigrina* [sic] Velasco (1879: 216), preoccupied by *Salamandra tigrina* Green (1825).

Ambystoma tigrinum velascoi Lafrentz, 1930: 105, pls. 2, 3. Type-locality, "Texcoco-See" (Lake Texcoco, Mexico). Holotype, not known with certainty, perhaps Mus. Magdeburg 53/29; collector possibly K. Lafrentz.

Ambystoma tigrinum velasci: Dunn, 1940: 157. First use of the present combination.

• DEFINITION. Transformed adults have yellow to olive spots or small blotches scattered irregularly over the dorsum and sides of the body; there are 6–45 (mean 29) such markings between extremes of limb insertions. Neoteny is common; larvae have 15–20 (mean 17) rakers on the anterior face of the third gill arch.

• REMARKS. This form cannot be distinguished adequately from *A. t. tigrinum* but is distinct from other races, sometimes resembling it in adult coloration, on the basis of gill raker counts. It has been considered a distinct species recently (Smith and Taylor, 1948). Northern range limits and possible intergradation with *A. t. tigrinum*, *A. t. mavortium*, and *A. t. nebulosum*, none of which has been recorded from Mexico with certainty, are unknown. Dunn (1940) confused *A. rosaceum* and *A. t. velasci*. Both Lafrentz and Wolterstorff (1930: 132) described *A. t. velascoi*, evidently without knowing of Dugès' earlier use of the similar name, *velasci*. Smith and Taylor (1948: 12) give reasons for citing Lafrentz instead of Wolterstorff as the author of *velascoi*.

7. *Ambystoma tigrinum diaboli* Dunn Gray tiger salamander

Ambystoma tigrinum diaboli Dunn, 1940: 160. Type-locality, "Devil's Lake, North Dakota" (Ramsey County). Holotype, Univ. Michigan Mus. Zool. 50156, collected by M. Brannon.

• DEFINITION. Transformed adults have small, dark brown to black spots scattered over a light olive to dark brown dorsum and sides; the spots tend to coalesce, forming short reticulations and number 26–173 (mean 71) between extremes of limb insertions. Neoteny is frequent; larvae have 18–24 (mean 20) rakers on the anterior face of the third gill arch.

• REMARKS. There is less ontogenetic change in the coloration of this race than any other. Adult coloration is essentially like that of most large larvae and especially the neotenes of all subspecies. Larvae often transform at snout-vent lengths exceeding 85 mm., a feature of life history unusual though not unknown in other subspecies.

COMMENTS

Like Dunn (1940) I have used adult coloration, larval gill raker counts, and incidence of neoteny in subspecies definitions. My rationale: (1) adult coloration is the most generally available criterion although subject to much ontogenetic variation; (2) gill raker count is the best character for distinguishing larvae but varies clinally on a transcontinental scale; (3) neoteny may exert considerable genetic influence, through possible sympatric isolation of neotenes from other larvae and breeding adults.

Counts of body markings between extremes of limb insertions do not include the limbs proper or those markings confluent with light ventral coloration unless the latter show a constriction at the point of confluence. Where a definite constriction between coalesced spots is visible, each spot is counted separately. All projections, whether bumps or actual rakers, are counted as gill rakers on the left side of non-neotenic larvae 45–85 mm. snout to posterior end of the vent.

As Lowe (1955) said, "There is an increasing effort among commercial 'waterdog' [= mudpuppy or large larval *A. tigrinum*] enterprises . . . . which supply fishermen with live bait. Contamination of local breeding populations with animals from other localities is proceeding at an accelerating rate . . . . " Thus future studies of *A. tigrinum* should account for the natural or artificial derivation of populations.

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